

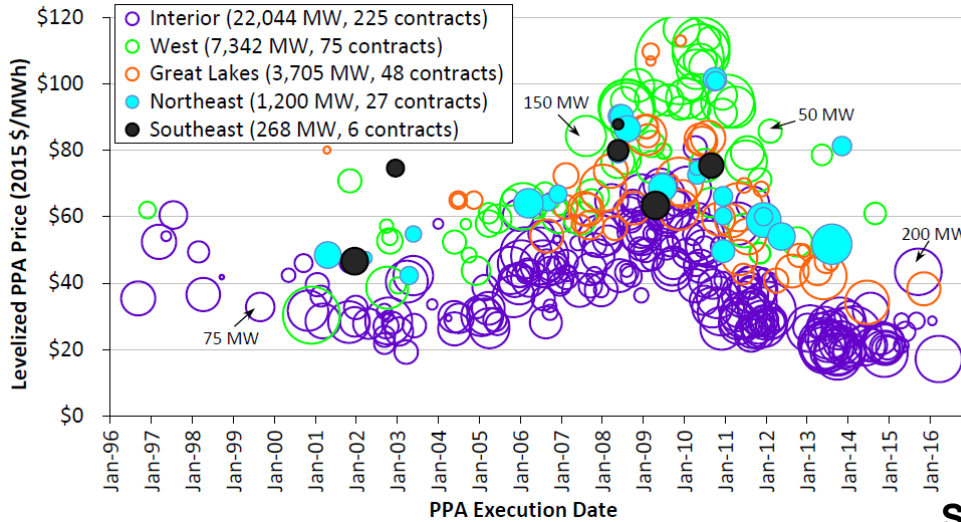


Technology Economics

- JISEA

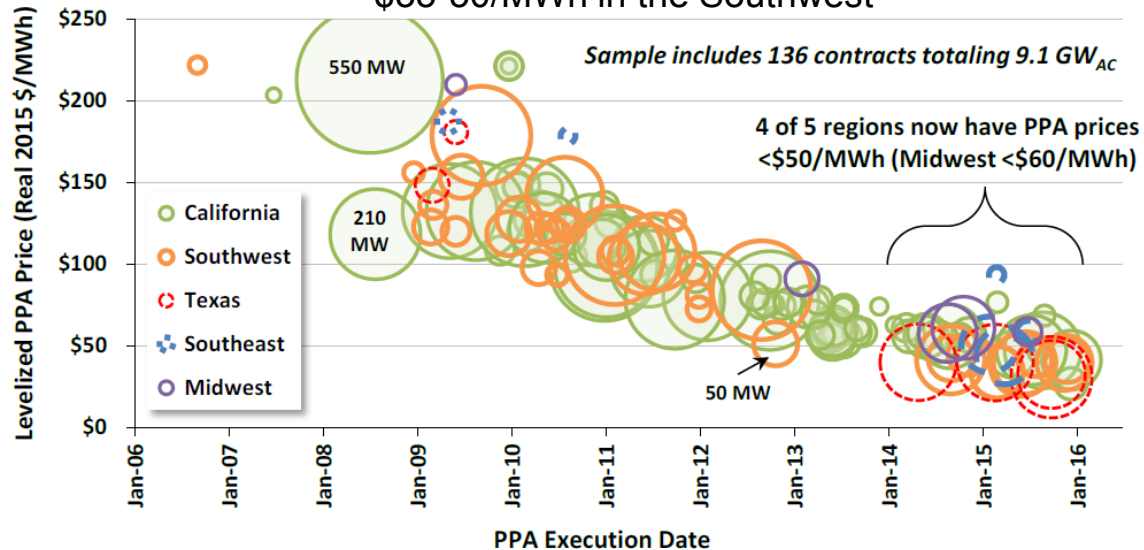
Cost Declines are Transforming the Renewables Business

Wind PPA prices are at historical lows
\$15-25/MWh in the Great Plains region

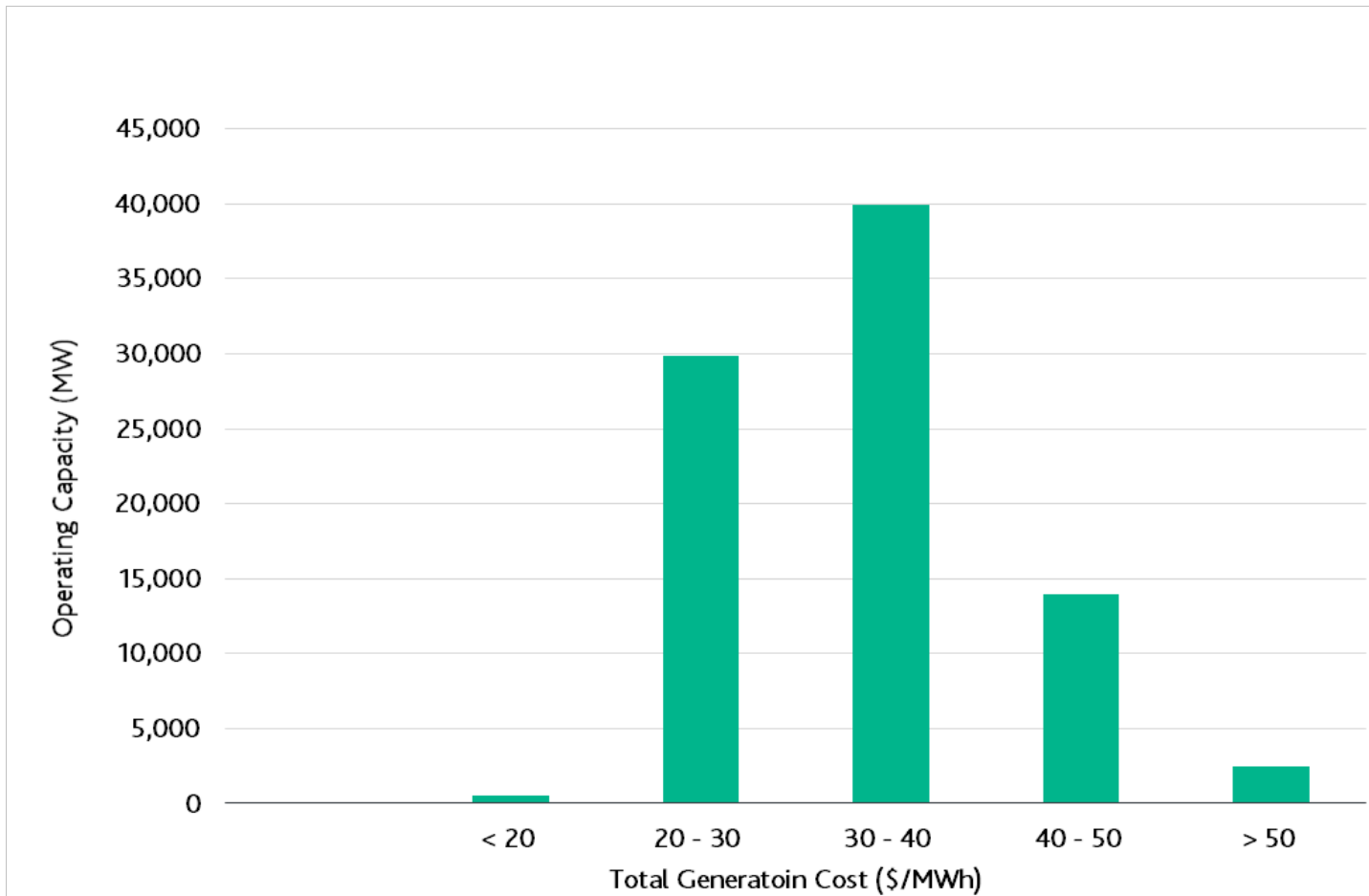


Source: Lawrence Berkeley National Laboratories

Solar PPA pricing has fallen ~75% in 8 years
\$35-50/MWh in the Southwest



Wind vs Coal Economics in the Great Plains



Storage - Peak Shaving Closest to Economic Viability

Utility	State	Demand Charge (\$/kW-mo)	Breakeven Installed Cost (\$/kWh)	
			No Energy Margin	4c/kWh
Consolidated Edison of New York - Rate I	NY	28.16	475	542
Consolidated Edison of New York - Rate II	NY	36.3	612	680
Hawaiian Electric Co	HI	24.34	411	478
Pacific Gas & Electric Co.	CA	24.11	407	474
Public Service Electric & Gas Co.	NJ	19.67	332	399
Southern California Edison Co	CA	24.78	418	486
The United Illuminating Co	CT	20.72	350	417

- New York City is the most promising market
 - Followed by HI, CA and Northeastern states
 - Breakeven installed costs in the range of \$400-600/kWh

- Key Factors:
 - “Peakiness” of load profile
 - Utility tariff structure
 - Fire Code !!

- Will lead to “cost shifting” among utility customers

Grid Storage Needs Contracts Until Prices Fall Further

	Latest Capacity Price	Breakeven Battery	Installed Cost (\$/kWh)
Region	\$ / MW-day	No energy Margin	\$20/MWh energy margin
NYC	510	248	268
NYISO - Zone G-J	279	136	155
NE-ISO (SEMA new plant)	583	284	303
California*	493	240	259
PJM - RTO	165	80	100

- Batteries in the grid
 - As alternative to gas peakers
 - Reduce grid capex for T&D

- Regulatory Support will be critical
 - Breakeven installed costs in the range of \$100-300/kWh
 - Growth through contracts for the foreseeable future
 - CA, HI and NY lead

- Grid rules will be a key factor

- Credit Implications: Negative for power producers, less so for utilities

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